

**Patent Claims:**

1. Method of integrating electrically conductive marker substances into paper pulp lines (6) for documents, securities and bank notes,  
5 characterized by the fact that the marking substance is included in or applied on the paper pulp line (6) and that for this purpose the marking substance is fed from a supply vessel (26) to output tubes (17) or, when producing water marks in the paper pulp line, it is fed from the supply vessel (16) to the paper pulp line (6) from embossing segments  
10 (25) of a water mark embossing roller (5) by way of marking substance transfer rollers (7).
2. Method of claim 1, characterized by the fact that an electrically  
15 conductive transparent polymer is used as marking substance.
3. Method of claim 1, characterized by the fact that electrically conductive pigments with a support medium are used as marking substance.
4. Method of claim 1, characterized by the fact that a combination of  
20 electrically conductive transparent polymers and electrically conductive pigments are used as marking substance.
5. Method of one or more of the preceding claims, characterized by the  
25 fact that the marking substance is connected to the paper pulp line (6) as a
  - dispersion,
  - suspension,
  - solution or
  - as a monomer together with a polymerizing agent.  
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6. Method of one or more of the preceding claims, characterized by the

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fact that the marking substance is partially or homogeneously included in the paper pulp line (6).

- 5 7. Method of one or more of the preceding claims, characterized by the fact that the marking substance is partially or homogeneously applied onto the paper pulp line (6).
- 10 8. Method of one or more of the preceding claims, characterized by the fact that the marking substance is homogeneously mixed with the paper pulp, preferably in a machine vat (8).
- 15 9. Method of one or more of the preceding claims, characterized by the fact that the marking substance is fed by a pump (20) from a supply vessel (26) to output tubes (17) provided with a valve (19) and a control unit (18).
- 20 10. Method of one or more of the preceding claims, characterized by the fact that the output tube (17) is structured such that the marking substance drips onto the paper pulp line (6) at uniform spacing or that it allows a continuous outflow of the marking substance in order to apply it linearly onto the paper pulp line.
- 25 11. Method of one or more of the preceding claims, characterized by the fact that the marking substance is transferred partially as an image of an embossing segment (25) of the water mark roller (5) or as part of the image of the embossing segment (25) so that in the embossed section either all or a portion of the water mark is provided with electrically conductive marker substance.
- 30 12. Method of one or more of the preceding claims, characterized by the fact that for controlling the homogeneous or partial presence of

marking substance the paper pulp line provided with electrically conductive marking substance is monitored by a testing and control device and that the supply of marking substance is regulated of the control device.

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13. Electrically conductive marking substance for security elements to be included in paper pulp lines for controlling documents, securities, bank notes, wrappings and products, characterized by the fact that the electrically conductive marking substance structured as an electrically conductive polymer as described in claim 5 is connected with a foil of a security element to be included in the paper pulp line.

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14. Electrically conductive marking substance of claim 13, characterized by the fact that the electrically conductive polymer is at least partially applied, preferably as a printed image, onto the security element to be included in the paper pulp line.

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15. Electrically conductive marking substance of claim 13, characterized by the fact that a foil structure serving as a security element comprising at least a support foil (28) and a metallization (29) applied to the support foil (28) with sectional demetallizations up to the edge of the support foil (28) is provided with a further layer (30) of an electrically conductive polymer and that the foil structure is embedded partially or completely in the paper pulp line.

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16. Electrically conductive marking substance of claim 13, characterized by the fact that the further layer (30) is used as a bonding agent between the support foils (28) and between the support foils (28) and the metallization (29) of the foil structure serving as the security element as well as as bonding agent between the foil structure and the paper pulp line.

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17. Electrically conductive marking substance of claim 13, characterized by the fact that the metallization (29) is applied on one side of the support foil (28) and that the further layer (30) of the electrically conductive polymer is applied to the other side.
  18. Electrically conductive marking substance of one or more of claims 13 to 17, characterized by the fact the metallization (29) is applied to one side of the support foil (28) and that the further layer (30) of the electrically conductive polymer is applied to the metallization (29).
  19. Electrically conductive marking substance of one or more of claims 13 to 18, characterized by the fact that the metallization (29) applied to one side of the support foil (28) is covered by a second support foil (28) and that the further layer (30) of the electrically conductive polymer is applied to at least one of these support layers (28).
  20. Electrically conductive marking substance of one or more of claims 13 to 19, characterized by the fact that the further layer (30) of the electrically conductive polymer has a higher stretch value than the metallization applied to one of the support foils (28; 2).
  21. Electrically conductive marking substance of one or more of claims 13 to 20, characterized by the fact the marking substance is a printing ink containing an electrically conductive polymer.
  22. Electrically conductive marking substance of one or more of claims 13 to 21, characterized by the fact that the marking substance is an electrically conductive polymer the specific surface resistance of which may be set in accordance with the manner in which it is applied, in the manner of its integration and/or by its composition and/or by its specific formulation.

23. Electrically conductive marking substance of one or more of claims 13 to 22, characterized by the fact that the marking substance is an electrically conductive polymer the resistance of which is in the range of from 20 to 40 kOhm/sq.
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24. Electrically conductive marking substance of one or more of claims 13 to 23, characterized by the fact that the marking substance is an electrically conductive polymer having a grid structure causing the electrical conductivity.
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25. Electrically conductive marking substance of one or more of claims 13 to 24, characterized by the fact the marking substance is an electrically conductive polymer the electric conductivity of which is caused by additives.
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26. Electrically conductive marking substance of one or more of claims 13 to 25, characterized by the fact the marking substance is an electrically conductive polymer the additive of which at least one pigment recognizable by human vision.
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27. Electrically conductive marking substance of one or more of claims 13 to 26, characterized by the fact that the marking substance is an electrically conductive polymer the marking pigments are optically active or activatable and are recognizable by optical test devices.
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28. Electrically conductive marking substance of one or more of claims 13 to 27, characterized by the fact that the marking substance is an electrically conductive polymer the additive of which has magnetic properties.
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29. Electrically conductive marking substance of one or more of claims 13

to 28, characterized by the fact that the marking substance is an electrically conductive polymer the marking pigments of which render the additives with magnetic properties imperceptible.

- 5    30.    Electrically conductive marking substance of one or more of claims 13 to 29, characterized by the fact that the security element to be included in the paper pulp line in addition to the electrically conductive polymer is provided with optical encoding.
- 10   31.    Electrically conductive marking substance of one or more of claims 13 to 30, characterized by the fact that the security element to be included in the paper pulp line in addition to the electrically conductive polymer is provided with magnetic encoding.
- 15   32.    Electrically conductive marking substance for security elements to be included in paper pulp lines for testing document, securities, bank notes, wrappings and products, characterized by the fact that the marking substance is an electrically conductive polymer as described in claim 5, which connected to a support material as a liquid application  
20   substance as a solution, a dispersion or suspension or as a monomer together with a polymerizing agent.
- 25   33.    Electrically conductive marking substance of claim 32, characterized by the fact that it consists of 3,4-ethylene dioxythiophene (EDT) and preferably is a PEDT/PSS (polyethylene dioxythiophene polystyrene sulfonate).
- 30   34.    Electrically conductive marking substance of claim 32, characterized by the fact that the PEDT/PSS used preferably is in accordance with formulation CPP105.

35. Electrically conductive marking substance of claim 32, characterized by the fact that a monomer, for instance 3,4 ethylene dioxythiophene, is brought into contact with a support material, together with a polymerizing agent, for instance, a solution of iron-III-toluene sulfonate in n-butanol.
36. Electrically conductive marking substance of one of claims 32 to 35, characterized by the fact that the electrically conductive polymer is transferred to the support material by conventional transfer processes.
37. Electrically conductive marking substance of one of claims 32 to 35, characterized by the fact that the electrically conductive polymer is applied to the support material by a printing, spraying or dipping method.
38. Electrically conductive marking substance of one of claims 32 to 35, characterized by the fact that the support material is the paper line itself or a foil to be included in the paper line.
39. Electrically conductive marking substance of one of claims 32 to 35, characterized by the fact that the support material is a bonding agent or primer provided on a base material.
40. Electrically conductive marking substance of one of claims 32 to 35, characterized by the fact that the support material is a wrapping or a product.
41. Electrically conductive marking substance of one of claims 32 to 35, characterized by the fact that the support material is a security element recognizable by human vision.

42. Electrically conductive marking substance of one of claims 32 to 35, characterized by the fact that the electrically conductive polymer is transparent.
- 5 43. Electrically conductive marking substance of one of claims 32 to 35, characterized by the fact that the electrically conductive polymer is almost transparent.
- 10 44. Electrically conductive marking substance of one of claims 32 to 35, characterized by the fact that the electrically conductive polymer has a metallic appearance.
- 15 45. Electrically conductive marking substance of one of claims 32 to 35, characterized by the fact that the electrically conductive polymer is opaque to transmitted light.
- 20 46. Electrically conductive marking substance of one of claims 32 to 35, characterized by the fact that the electrically conductive polymer in use is indistinguishable from its surroundings.
- 25 47. Electrically conductive marking substance of one of claims 32 to 35, characterized by the fact that the electrically conductive polymer in use is distinguishable from its surroundings.
- 30 48. Electrically conductive marking substance of one of claims 32 to 35, characterized by the fact that the electrically conductive polymer is applied to the support material as at least one continuous surface.
49. Electrically conductive marking substance of one of claims 32 to 35, characterized by the fact that the electrically conductive polymer is applied to the support material as a surface divided by at least one



interruption.

50. Electrically conductive marking substance of one of claims 32 to 35,  
characterized by the fact that the electrically conductive polymer is  
5 applied to the support material as at least one line.
51. Electrically conductive marking substance of one of claims 32 to 35,  
characterized by the fact that the electrically conductive polymer is  
10 applied to the support material as dots.
52. Electrically conductive marking substance of one or more of claims 13  
to 51, characterized by the fact that as an electrically conductive  
polymer the electrically conductive marking substance prior to its  
application to the paper line is connected to at least a foil, a curable  
15 lacquer layer, a reflection layer and a protective layer.
53. Method of testing electrically conductive marking substances  
integrated in the paper pulp line of documents, securities, bank notes,  
wrappings and products, characterized by the fact that for purposes of  
20 multiple testing the marking substance is detected on the basis of its  
data of electrical conductivity and/or other physical parameters and/or  
chemical properties.
54. Method of testing according to claim 53, characterized by the fact that  
25 a scanning sensor (10;11) is activated by optical, magnetic and/or  
mechanical sensors (13) and that the scanning sensor (10;11) for  
detecting the electric conductivity consists of a plurality of scanning  
channels which scan the electric conductivity.
55. Method of testing according to claim 53, characterized by the fact that  
30 the electric conductivity is scanned over the entire width of the paper  
pulp line (6) by capacitive scanning sensors (11).

56. Method of testing according to claim 53, characterized by the fact that for reducing cross-talk the scanner channels are controlled by energizing the even- numbered sensor channels (21) in a first scanning step and energizing the uneven-numbered scanning channels (22) in each second scanning step, the scanning frequency being preferably 200 kHz.
57. Method of testing according to claim 53, characterized by the fact that the spacing between transmitting electrodes and receiving electrodes of the capacitive scanning sensors (11) is switched in accordance with the test structures and the test plane.
58. Method of testing according to claim 53, characterized by the fact that the optical properties of the electrically conductive marking substance is used as a reference value for the electric conductivity for doubly testing this characteristic.
59. Method of testing according to claim 53, characterized by the fact that a hold-down feature structured as a roller or guide rail and positioned opposite the scanning sensor (10;11) optimizes the transport of the paper pulp line (6).
60. Method of testing according to claim 53, characterized by the fact that the paper pulp line (6) is tested on both sides by sensors electrodes one functional electrode side of which is disposed above the paper pulp line (6) and the other functional electrode side of which is disposed below the paper pulp line (6) to be tested.
61. Method of testing according to claim 53, characterized by the fact that the maintenance of production parameters is tested by a plurality of scanning sensors (10;11) arranged over the entire width of the paper pulp line (6).

62. Method of testing according to claim 53, characterized by the fact that a control circuit at the output of the scanning sensors (10;11) regulates the supply of marking substance.

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